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# MOVEMENT ABILITY OF CULTURED HAWKSBILL TURTLE IN THE OPEN SEA DETERMINED BY SATELLITE

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## ABSTRACT

Sea turtle tagging and releasing program in the Gulf of Thailand is one of the activities for conservation and management conducted by Mannai Sea Turtle Conservation Station, Department of Fisheries, Thailand. Many turtles are cultured and kept in captivity for reproduction and release to the wild. In 2001, satellite telemetry was employed to study on movement ability of cultured hawksbill turtles after release. Four juvenile and sub-adult hawksbill turtles aged 4-12 years old were fitted with Platform Transmitter Terminals (PTTs) on their carapace. Signal data obtained showed that all hawksbills moved randomly along the coastline in the northern part of the Gulf of Thailand within water depths of 20 m, probably to search for suitable feeding areas. The movements to many areas without any oriented directions throughout the 2-3 months of tracking seemed to indicate that juvenile hawksbills could not decide to stay in any fixed habitats while sub-adult turtles appeared to show a more directed search for feeding areas. Swimming speed which was estimated from location fixes of high accuracy (LC 1-3) ranged from 0.45-0.57 km hr<sup>-1</sup>. Since the movements of the hawksbills appeared disorderly and complex, it was not possible to make conclusions on their behavior in the open sea.

**Keywords:** *hawksbill turtle, satellite telemetry, cultured sea turtle*

## INTRODUCTION

The Sea Turtle Conservation Station at Mannai Island, a small island located 6 km off the Rayong coast in the Gulf of Thailand belongs to the Department of Fisheries, Thailand. The main activity is to culture sea turtles for eventual release to the wild. Since 1996 some of the captive-raised hawksbills aged 15 years or more have successfully commenced to nest on the artificial beach of the breeding pond. It has been planned to release some cultured turtles to the open sea. It would be ideal if it is possible to track the movements of the turtles after release in order to understand their behaviour in the wild and their ability to locate feeding areas when introduced to the natural environment for the first time. If they exhibit efficiency in searching for foraging sites in the first few days, it may indicate that cultured turtles can survive normally when released to the natural environment. Therefore satellite telemetry was employed to chart out the movement patterns and behavior of the captive-raised turtles to provide some guidelines for sea turtle conservation programs in the future.

## MATERIALS AND METHODS

Four pen-reared hawksbill sea turtles *Eretmochelys imbricata*, comprising two juveniles and two sub-adults from Mannai Island hatchery (12.61 N, 101.69 E), were chosen for release and tracking in the open sea with satellite transmitters (PTTs) on 26 April 2001.

Kiwisat-101 transmitters were deployed on the carapace of each turtle with putty glue and reinforced with fiberglass cloth and polyester resin covering the PTTs. The procedure for PTT attachment and data reception and analysis via the Argos-linked system for sea turtles were the same as described by many previous studies (Balazs et al., 1994; Liew et al., 1995 and Sakamoto et al., 1997). The swimming speed of turtles was calculated by employing two reliable locations of LC 1-3 accuracy (variable distance within 1,000 m) and the time lapsed between them. Sea surface temperature and surfacing time in each turtle position were considered only for diving activity and reasonable survival in the wild. The culture data and the duration of signal received for the turtles are summarised in Table 1.

Table 1. Information of cultured hawksbills attached with satellite transmitters.

Turtle No.	Type	Age (yr)	Body size CCW x CCL(cm)	Weight (kg)	Signal received (days)
13305	Juvenile	4	58.0 x 60.5	26	67
13306	Juvenile	4	58.0 x 60.5	24	33
13307	Sub-adult	11	65.0 x 72.0	42	81
13308	Sub-adult	12	66.0 x 72.0	51	136

## RESULTS AND DISCUSSION

**Juveniles:** The movements of the two tracked juvenile hawksbills (No.13305 and 13306) are shown in Fig.1. They both seemed to be searching randomly along the coast of the Gulf of Thailand not far away from the release point at Mannai Island. Turtle 13305 swam across the gulf to reach the west-coast of the gulf in 26 days, and then returned quite immediately to the east-coast, past the release point to the waters around Ko Chang Island, the second biggest island in Thailand. The last position was found close to shore near Mannai Island after 67 days of release. Turtle 13306 moved only short distances from the release point and did not seem to make a determinate route for her journey. Initially she moved around Mannai Island for about 20 days, and thereafter she headed to the west and stayed around the waters near Ko Khram Island, where the largest concentration of turtle nesting are found in Thailand.

**Sub-adults:** The two sub-adult hawksbill turtles moved longer distances and traveled faster than the juveniles. Turtle 13307 started her journey along the coast of the Gulf of Thailand towards the west and then returned to the east until she reached Vietnam waters after 81 days of travel (Fig. 2). However, for the last 10 days of transmission, the surface time data indicated 100% exposure to the atmosphere. It was possible that the turtle was landed as a result of incidental capture or there had been a malfunction of the PTT. Surface temperatures from the turtle during that time showed wide fluctuations. Turtle 13308 showed wide-ranging movements (Fig. 2). She stayed a long time (in excess of 3 months) in the near shore waters of the inner gulf of Thailand after traveling about 100 km during the first month of release.

**Movement speed and sea surface temperature:** Swimming speed and surface temperature during movement in the sea are summarized in Table 2. Sea surface temperature for turtle 13307 showed wider ranges than the other turtles, indicating that she was out of water before transmission terminated. The mean speed of the cultured turtles calculated from location classes (LC 1-3) ranged between 0.42-1.37 km/hr. The cruising speed of turtle 13308 apparently to a determined destination, probably a feeding ground averaged 0.42 km/hr (range 0.34-0.60 km/hr) while the other turtles

13305-07 moved with an average speed (0.96-1.37 km/hr) which is almost identical to swimming speeds of adult turtles in the natural environment.

Table 2. Summary of sea surface temperature and movement speed of cultured hawksbills

Turtle	Type	Mean surface Temperature (C)	Range in temp. (C)	Mean speed of movement (km hr <sup>-1</sup> )	Range in speed (km hr <sup>-1</sup> )
13305	Juvenile	30.8	29.5 - 35.0	0.96	0.1 - 5.4
13306	Juvenile	31.5	30.5 - 33.0	1.37	0.2 - 3.9
13307	Sub-adult	30.9	24.0 - 35.0	1.01	0.1 - 3.9
13308	Sub-adult	31.0	28.0 - 33.0	0.42	0.3 - 0.6

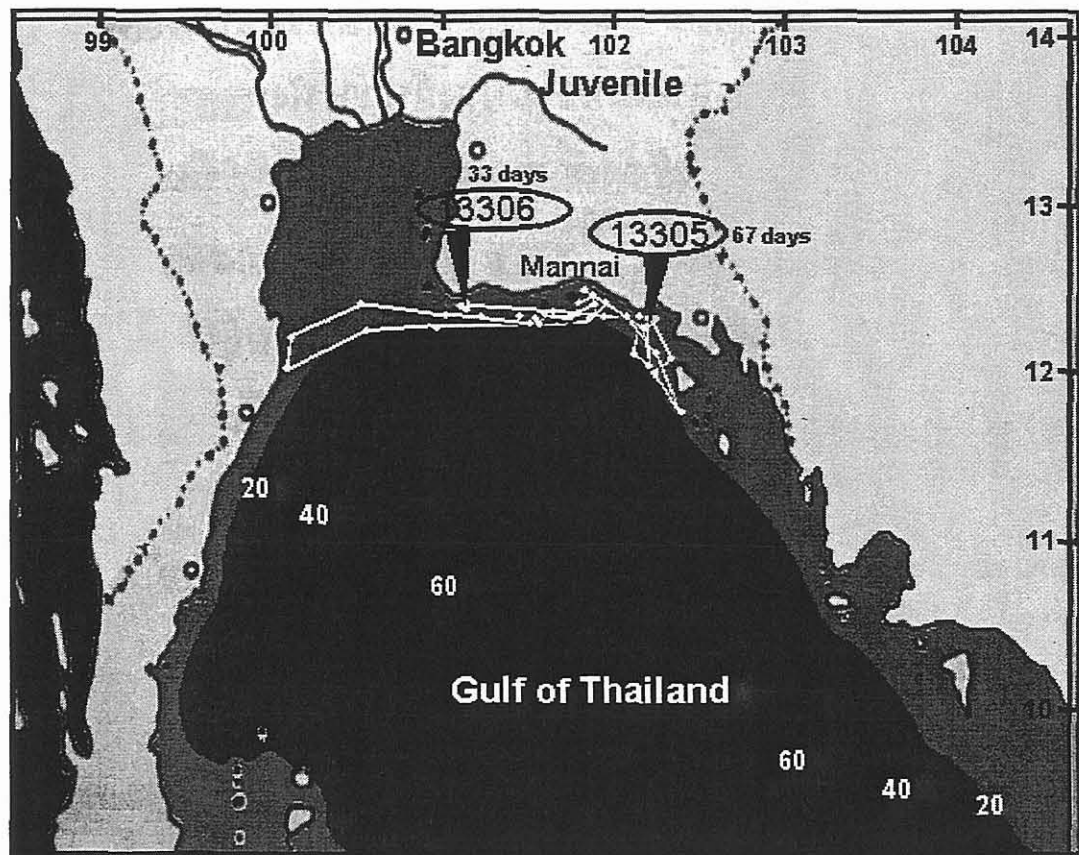


Figure 1. Track routes of two juvenile hawksbills released at Mannai Island, Gulf of Thailand

### CONCLUSION

1. Captive-raised juvenile turtles moved randomly in shallow water within depths of 20 m after release to the wild.. They appeared to be searching for suitable feeding areas, but the transmission duration from their PTTs were too short to provide sufficient data on feeding areas and their habitat.

2. Captive-raised sub-adult turtles traveled longer distances than juveniles along the coast. Transmission signals from one turtle were evidently erroneous as surfacing time were 100% towards the last few days of transmission. E

3. Although all turtles had never been in the open sea before release, their swimming speeds averaging 1-2 km/hr (these are not the figures shown in the table) are comparable to those of wild turtles.

4. Cultured hawksbill turtle of 4 years in age could be strong enough to move in the wild. However, we need more information on feeding activity of juveniles.

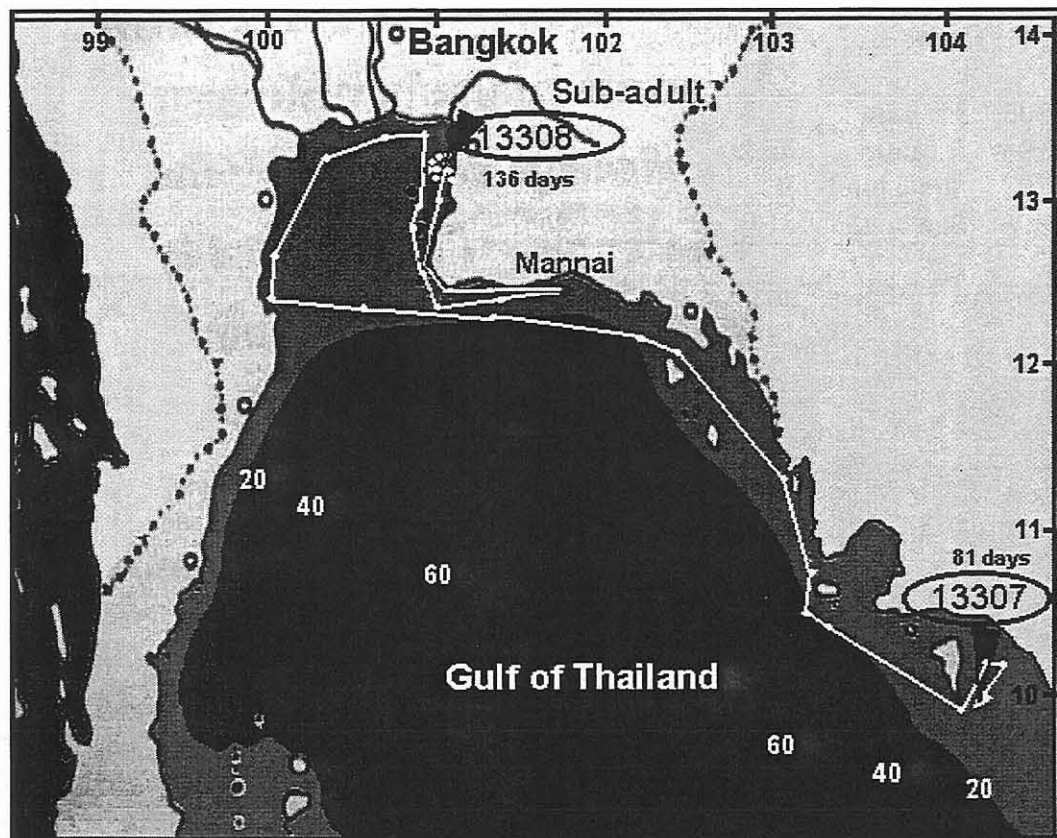


Figure 2. Track route of two sub-adult hawksbills released at Mannai Island, Gulf of Thailand

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